REMARKS/ARGUMENTS

Status of Claims

Claims 8-14, 16, 17, 23-28, 30-36, and 38-41 are being resubmitted. Claims 8, 9, 13, 14, 16, 17, 23, 24, 30, 33, 34, and 41 have been amended. Claims 1-7, 10, 15, 18-22, 29, 37, and 42 have been canceled without prejudice or disclaimer of the subject matter. New Claims 43-58 have been added.

Support for the new Claims 43-58 can be found, for example, in the detailed description in paragraphs [0038] - [0046], [0050], and [0055] - [0062], and in Figures 1, 3, and 4. No new matter was added.

Claim 41 was objected to based on an insufficient antecedent basis for a claim limitation. Claim 1 was rejected under 35 U.S.C. 102(b) as being anticipated by Bolda et al. (U.S. Patent No. 6,204,751). Furthermore, Claims 15, 19, 21, and 22 were rejected under 35 U.S.C. 102(b) as being anticipated by Sexton (U.S. Patent No. 5,807, 141). The Office Action further rejected Claims 2-14, 24-40, and 42 under 35 U.S.C. 103(a) as being unpatentable over Bolda et al. (U.S. Patent No. 6,204,751). The Office Action still further rejected Claims 16-18 under 35 U.S.C. 103(a) as being unpatentable over Sexton (U.S. Patent No. 5,807,141) in view of Bax (U.S. Patent No. 6,583,975). The Office Action still further rejected Claim 20 under 35 U.S.C. 103(a) as being unpatentable over Sexton (U.S. Patent No. 5,807,141). The Office Action still further rejected Claims 23 and 41 under 35 U.S.C. 103(a) as being unpatentable over Bolda et al. (U.S. Patent No. 6,204,751) in view of Sexton (U.S. Patent No. 5,807,141).

Examiner Interview

A telephone interview was conducted between the Examiner and Applicant's representative. Amendments to the claims were discussed. Further discussed were the cited references Bolda et al. (U.S. Patent No. 6,204,751) and Sexton (U.S. Patent No. 5,807,141).

In such interview, the Examiner indicated that the discussed prior art references could be overcome by amending the Claims. No further agreement was reached.

Claim Objections

Claim 41 has been amended by deleting "first" from the limitation "said at least one first electrical circuit" as requested in the Office Action to provide sufficient antecedent basis for this limitation in the claim.

Section 102(b) Rejections

Bolda et al. (U.S. Patent No. 6,204,751)

Bolda et al. teach a current inrush limiting circuit with fast reset. The circuit may be used for controlling transient currents on power conductors and includes a voltage-controlled switch connected between one of the power conductors and a load. Bolda et al. illustrate in Figure 2 a motor overload relay module 44 that includes a sensing module 56 and a control module 58. The sensing module 56 includes sensors 62a-c, and 64 that monitor line current on three-phase power lines connected with the motor. The four sensors can be Hall effect sensors (Col. 5, lines15-19), or current transformers (Col. 5, line 23). Hall effect sensors typically detect a magnetic field generated by the load wire as the current flows through the load wire and a magnetic core magnifies the magnetic field to allow easier detection. A Hall effect sensor will provide a

signal when the magnetic field goes beyond the threshold. Current transformers are common devices, usually consisting of a magnetic core material and windings that pick up the currents induced by a wire that has a current flow. The control module 58 shown by Bolda et al. in Figure 2 includes a micro-controller 72. The microcontroller 72 may be configured to determine the existence of a fault condition based on the signals received from the conditioning circuitry 68 and 70, which are connected to the sensors 62a-c and 64 (Col.5, lines 30-35). The micro-controller 72 may be programmed to calculate a current imbalance condition that is indicative of a ground fault. The micro-controller may further determine a loss of phase condition (Col. 5, lines 44-46). If either a ground fault condition or a loss of phase condition is detected, the micro-controller 72 will provide an output signal sufficient to energize a coil 76 of a trip-relay which causes opening of a relay switch 78 (Col. 5, lines 45-50). The use of the micro-controller 72 has the disadvantage that it must sample the signal from the conditioning circuitry 68, 79 to determine if there is a fault condition (current imbalance). The problem with this is that the fault could occur in-between the sample periods and potentially miss of the fault occurrence.

Contrary to Bolda et al., the present invention, as in new Claim 43, in Claim 8 (as amended), teaches a ground and line fault interrupter (illustrated, for example in Figure 1) that uses a magnetic core 132 through which the three load wires of a three-phase system that powers an electrical load extend. Multiple conductive windings 134 are arranged on the magnetic core 132 such that the current flow through the load wires can be monitored and imbalances in the current flow can be detected. The load current flowing through the load wires creates a magnetic field that induces a current onto the windings 134. Contrary to Bolda et al. who use 4 sensors to detect a ground fault condition or a loss of phase condition, the magnetic core 132 and the windings 134 of the present invention are arranged such that allows the core/windings set to not

only detect the current flow through the load wires but can be used to determine imbalances between the three load wires that allows for detection of line to line shorts and not just line to ground shorts, as in Figure 1, Claim 43 (new), Claim 8 (as amended), and paragraphs [0038] to [0045] of the present invention. The arrangement of the four sensors 62a-c and 64 as shown in Figure 2 by Bolda et al. do not allow the determination of line-to-line shorts. Furthermore, the present invention may be used to detect fault conditions (shorts) that are below the current trip levels for a circuit breaker system 121 (Figure 1) already integrated in an electrical circuit providing power to a device upstream from the ground and line fault interrupter. Two sensing circuits 140 and 142 monitor the conductive windings 134 and detect imbalances in the current flow. If a current imbalance increases beyond a preset threshold, the sensing circuits will provide a fault current to a circuit breaker detector 138, which is a printed wiring board circuit breaker (shown in Figure 1), that trips the circuit breaker detector 138 (as in new Claim 43 and in Claim 8, as amended). Using a printed wiring board circuit breaker as shown in Figure 1 of the present invention, has the advantage that the circuit breaker may be tripped on very low current draw. Typically, circuit breaker included in circuit breaker systems for electrical circuits, such as the circuit breaker system 121 shown in Figure 1 of the present invention are designed to handle potentially very large current loads. To prevent having very large components on the ground and line fault interrupter adapter (Figures 3 and 4, as in new Claim 57 and in amended Claim 23, to open the load lines directly, the small printed wiring board circuit breaker is used to provide a trip signal to the existing circuit breaker system 121 (Figure 1, as in new Claim 43 and amended Claim 8). The trip signal (electronic fault signal - as in new Claim 43) commands the larger circuit breaker system 121 to open the three sections 128, 126, and 124, as shown in Figure 1. Since the a printed wiring board circuit breaker 138 is analog, it continuously monitors the current fluctuations in the load wires and, thus, will not miss any fault condition, as possible by using the micro-controller 72 taught by Bolda et al. Since, contrary to Bolda et al., the

ground and line fault interrupter 130 (Figure 1, as in new Claim 43 and in Claim 8, as amended) does not actually open up the load lines directly but by utilizing the controls and functionality of the existing relay or circuit breaker systems of an electrical circuit, the ground and line fault interrupter 130 can be used in a wide variety of applications, for example, to retrofit existing electrical circuitry to provide ground and line fault protection, or in combination with a variety of circuit breaker types already installed in electrical circuits.

Therefore, Bolda et al. do not anticipate the present invention as in new Claims 43-54 and in Claims 8, 9, and 11-14 (as amended).

Sexton (U.S. Patent No. 5,807, 141)

Sexton teaches a flat, surface mounted, flexible, multi-purpose wire and outlets that provide connection points between the flat wires and conventional existing electrical outlets and conventional round wire systems (Col 8, lines 59-64). A pluggable outlet unit 65 illustrated in Figure 8A and 8B contains a flat wire connector 76 and a ground fault interrupter module 77. The ground fault module 77 contains two sets of male contacts that pass through openings in the housing of the outlet unit 65 to plug into respective female receptacles associated with conventional wiring systems (Col 9, lines 39-46).

The present invention as in new Claim 55 teaches an adapter module 156 that includes the ground and line fault circuitry as in Figure 1, new Claim 43, and amended Claim 8. The ground and line fault interrupter adapter module 156, as shown in Figure 3 of the present invention and claimed by new Claim 55 and Claim 23 (as amended), can be inserted in-between an existing socket 152 that is in electrical communication with an external electrical system and an electrical circuit module 158, which includes a relay module or a circuit breaker system 121. Therefore, the adapter module 156 provides ground and line fault

interrupter function without any modification to the existing wiring of an electrical system. The ground and line fault interrupter adapter module 156, as in new Claim 55, can be used with existing relay systems and with existing circuit breaker systems since it provides an electronic fault signal to either system once a detected fault current exceeds a preset threshold, which causes either the relay system or the circuit breaker system to open the load lines. While the pluggable outlet unit 65 taught by Sexton provides connection between flat wires and conventional existing electrical outlets and conventional round wire systems, the ground and line fault interrupter adapter module 156, as in new Claim 55 of the present invention, provides the ability to add ground and line fault detection and interrupter capability to older or existing electrical systems without changing the wiring or modifying the panels that contain conventional relays or circuit breakers. While the pluggable outlet unit 65 taught by Sexton only provides ground fault detection capabilities, the ground and line fault interrupter adapter module 156, as in new Claim 55 of the present invention, enables detection of line to line shorts as well as line to ground shorts.

Therefore, Sexton does not anticipate the present invention as in new Claims 55 and Claims 16 and 17 (as amended) either alone or with the other references of record.

Section 103(a) Rejections

Bolda et al. (U.S. Patent No. 6,204,751)

Bolda et al. teach a current inrush limiting circuit with fast reset. The circuit may be used for controlling transient currents on power conductors and includes a voltage-controlled switch connected between one of the power conductors and a load. Bolda et al. illustrate in Figure 2 a motor overload relay module 44 that includes a sensing module 56 and a control module 58. The

sensing module 56 includes sensors 62a-c, and 64 that monitor line current on three-phase power lines connected with the motor. The four sensors can be Hall effect sensors (Col. 5, lines15-19), or current transformers (Col. 5, line 23). Hall effect sensors typically detect a magnetic field generated by the load wire as the current flows through the load wire and a magnetic core magnifies the magnetic field to allow easier detection. A Hall effect sensor will provide a signal when the magnetic field goes beyond the threshold. Current transformers are common devices, usually consisting of a magnetic core material and windings that pick up the currents induced by a wire that has a current flow. The control module 58 shown by Bolda et al. in Figure 2 includes a micro-controller 72. The microcontroller 72 may be configured to determine the existence of a fault condition based on the signals received from the conditioning circuitry 68 and 70, which are connected to the sensors 62a-c and 64 (Col.5, lines 30-35). The micro-controller 72 may be programmed to calculate a current imbalance condition that is indicative of a ground fault. The micro-controller may further determine a loss of phase condition (Col. 5, lines 44-46). If either a ground fault condition or a loss of phase condition is detected, the micro-controller 72 will provide an output signal sufficient to energize a coil 76 of a trip-relay which causes opening of a relay switch 78 (Col. 5, lines 45-50). The use of the micro-controller 72 has the disadvantage that it must sample the signal from the conditioning circuitry 68, 79 to determine if there is a fault condition (current imbalance). The problem with this is that the fault could occur in-between the sample periods and potentially miss of the fault occurrence.

Contrary to Bolda et al., the present invention, as in new Claims 43-54, in Claims 8, 9, 11-14, 24, 25-28, 30-36, 38-40 (as amended), and as in Figure 1, teaches a ground and line fault interrupter that uses a magnetic core 132 through which the three load wires of a three-phase system that powers an electrical load extend. Multiple conductive windings 134 are arranged on the

magnetic core 132 such that the current flow through the load wires can be monitored and imbalances in the current flow can be detected. The load current flowing through the load wires creates a magnetic field that induces a current onto the windings 134. Contrary to Bolda et al. who use 4 sensors to detect a ground fault condition or a loss of phase condition, the magnetic core 132 and the windings 134 of the present invention are arranged such that allows the core/windings set to not only detect the current flow through the load wires but can be used to determine imbalances between the three load wires that allows for detection of line to line shorts and not just line to ground shorts, as in Figure 1, Claim 43 (new), Claims 8, 24, and 33 (as amended), and paragraphs [0038] to [0045] of the present invention. The arrangement of the four sensors 62 a-c and 64 as shown in Figure 2 by Bolda et al. do not allow the determination of line-to-line shorts. Furthermore, the present invention may be used to detect fault conditions (shorts) that are below the current trip levels for a circuit breaker system 121 (Figure 1) already integrated in an electrical circuit providing power to a device upstream from the ground and line fault interrupter. Two sensing circuits 140 and 142 monitor the conductive windings 134 and detect imbalances in the current flow. If a current imbalance increases beyond a preset threshold, the sensing circuits will provide a fault current to a circuit breaker detector 138, which is a printed wiring board circuit breaker (shown in Figure 1), that trips the circuit breaker detector 138 (as in new Claim 43 and in Claims 8, 24, and 33, as amended). Using a printed wiring board circuit breaker as shown in Figure 1 of the present invention, has the advantage that the circuit breaker may be tripped on very low current draw. Typically, circuit breaker included in circuit breaker systems for electrical circuits, such as the circuit breaker system 121 shown in Figure 1 of the present invention are designed to handle potentially very large current loads. To prevent having very large components on the ground and line fault interrupter adapter (Figures 3 and 4, as in new Claim 55 and in amended Claim 23, to open the load lines directly, the small printed wiring board circuit breaker is used to provide a trip signal to

the existing circuit breaker system 121 (Figure 1, as in new Claim 43 and amended Claims 8, 24, and 33). The trip signal (electronic fault signal - as in new Claim 43) commands the larger circuit breaker system 121 to open the three sections 128, 126, and 124, as shown in Figure 1. Since the a printed wiring board circuit breaker 138 is analog, it continuously monitors the current fluctuations in the load wires and, thus, will not miss any fault condition, as possible by using the micro-controller 72 taught by Bolda et al. Since, contrary to Bolda et al., the ground and line fault interrupter 130 (Figure 1, as in new Claim 43 and in Claims 8, 24, 33, as amended) does not actually open up the load lines directly but by utilizing the controls and functionality of the existing relay or circuit breaker systems of an electrical circuit, the ground and line fault interrupter 130 can be used in a wide variety of applications, for example, to retrofit existing electrical circuitry to provide ground and line fault protection, or in combination with a variety of circuit breaker types already installed in electrical circuits. Since Sexton teaches an outlet unit that is pluggable into a conventional outlet and provides connection between electrical flat wire systems and electrical round wire systems it would not have been obvious to combine Sextons pluggable outlet unit 65 with the motor overload relay 44 of Bolda et al. to obtain the ground and line fault interrupter adapter module of the present invention as in new Claims 43-54 and in Claims 8, 9, 11-14, 24, 25-28, 30-36, 38-40 (as amended). Furthermore, it would not have been obvious to combine Sextons pluggable outlet unit 65 with the motor overload relay 44 of Bolda et al. since the motor overload relay 44 of Bolda et al. contains components too large to be included in an adapter module. Furthermore, neither Sexton nor Bolda et al. teach the detection of line-to-line shorts and, therefore, do not provide line fault interruption as the ground and line fault interrupter 130 (Figure 1) and the adapter module 156 (Figure 3) of the present invention.

Therefore, Bolda et al. do not anticipate or make obvious the present invention as in new Claims 43-54 and in Claims 8, 9, 11-14, 24, 25-28, 30-36,

38-40 (as amended) either alone or with the other references of record.

Sexton (U.S. Patent No. 5,807, 141)

Sexton teaches a flat, surface mounted, flexible, multi-purpose wire and outlets that provide connection points between the flat wires and conventional existing electrical outlets and conventional round wire systems (Col 8, lines 59-64). A pluggable outlet unit 65 illustrated in Figure 8A and 8B contains a flat wire connector 76 and a ground fault interrupter module 77. The ground fault module 77 contains two sets of male contacts that pass through openings in the housing of the outlet unit 65 to plug into respective female receptacles associated with conventional wiring systems (Col 9, lines 39-46).

The present invention, as in new Claim 55 and as in Claims 16, 17, 23, and 41 (as amended), teaches an adapter module 156 that includes the ground and line fault circuitry as in Figure 1, new Claim 43, and amended Claim 8. The ground and line fault interrupter adapter module 156, as shown in Figure 3 of the present invention, can be inserted in-between an existing socket 152 that is in electrical communication with an external electrical system and an electrical circuit module 158, which includes a relay module or a circuit breaker system 121. Therefore, the adapter module 156 provides ground and line fault interrupter function without any modification to the existing wiring of an electrical system. The ground and line fault interrupter adapter module 156, as in new Claim 55 and as in Claims 16, 17, 23, and 41 (as amended), can be used with existing relay systems and with existing circuit breaker systems since it provides an electronic fault signal to either system once a detected fault current exceeds a preset threshold, which causes either the relay system or the circuit breaker system to open the load lines. While the pluggable outlet unit 65 taught by Sexton provides connection between flat wires and conventional existing electrical outlets and conventional round wire systems, the ground and line fault

interrupter adapter module 156, as in new Claim 55 and as in Claims 16, 17, 23, and 41 (as amended), of the present invention, provides the ability to add ground and line fault detection and interrupter capability to older or existing electrical systems without changing the wiring or modifying the panels that contain conventional relays or circuit breakers. While the pluggable outlet unit 65 taught by Sexton only provides ground fault detection capabilities, the ground and line fault interrupter adapter module 156, as in new Claim 55 and as in Claims 16, 17, 23, and 41 (as amended), of the present invention, enables detection of line to line shorts as well as line to ground shorts. It would not have been obvious to combine Sextons pluggable outlet unit 65 with the motor overload relay 44 of Bolda et al. since the motor overload relay 44 of Bolda et al. contains components too large to be included in the outlet unit 65. Furthermore, it would not have been obvious to combine Sextons pluggable outlet unit 65 with the motor overload relay 44 of Bolda et al. since the overload relay 44 would not add line fault protection to the outlet unit 65.

Therefore, Sexton does not anticipate or make obvious the present invention as in new Claim 55 and as in Claims 16, 17, 23, and 41 (as amended) either alone or with the other references of record.

Bax (U.S. Patent No. 6,583,975)

Bax teaches an aircraft applicable ground fault circuit interrupter that interrupts a circuit when a current imbalance is sensed. The circuit interrupter includes a power supply, a sensor for sensing a current imbalance at the line side of the circuit, a logic controller, and a power controller. The power supply provides power to the sensor, logic controller, and the power controller. The logic controller receives input from the sensor, and the power controller receives input from the logic controller, and interrupts power to the load side of the circuit when the sensor senses a current imbalance. Power interruption due to a

sensed current imbalance is maintained until the power source is cycled. The circuit interrupter is preferably autonomous, requiring no additional signals, inputs, or sources of power (abstract). Bax teaches that the improved ground fault circuit interrupter device of his invention may be used where the load side of the circuit is connected to a motor or a fuel pump (Col. 1, lines 62-67).

Contrary to Bax who teaches a ground fault interrupter device that directly opens the load lines if a ground fault is detected, the present invention, as in new Claims 43 and 55 and as in amended Claims 8, 23, 24, 33, 41 and 43, teaches a ground and line fault interrupter and adapter module that provides detection of line to line faults (one load line shorted to another load line) as well as ground faults (load line shorted to a ground path) and that sends an electronic fault signal to a circuit breaker system or a relay system, which actually opens the load lines. Since the ground fault interrupter device of Bax does not enable line fault protection and does directly opens the load lines in case of a ground fault it would not have been obvious to combine the ground fault interrupter device with the pluggable outlet unit of Sexton, even if the device of Bax is used in connection with motors and fuel pumps as is the ground and line fault interrupter and adapter module of the present invention as in Claims 16 and 17, as amended.

Therefore, Bax does not anticipate or make obvious the present invention as in new Claim 55 and as in Claims 16, 17, (as amended) either alone or with the other references of record.

CONCLUSION

Applicant would like to thank the Examiner for the telephone interview of December 1, 2005. The suggestions made by the Examiner are reflected in this response.

Reconsideration and withdrawal of the Office Action with respect to Claims 8-14, 16, 17, 23-28, 30-36, and 38-41 is respectfully requested. Consideration of new Claims 43-58 is respectfully requested. It is believed that Claims 8-14, 16, 17, 23-28, 30-36, 38-41, and 43-58 are now in condition for allowance. Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

In the event the examiner wishes to discuss any aspect of this response, please contact the attorney at the telephone number identified below.

Respectfully submitted,

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